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Schulz, Torben

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Chapter 3

The role of personal characteristics in the relationship between health and psychological distress among kidney transplant recipients

Torben Schulz

Jan Niesing

Roy E. Stewart

Ralf Westerhuis

Mariët Hagedoorn

Rutger J. Ploeg

Jaap J. Homan van der Heide

Adelita V. Ranchor

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ABSTRACT

Although kidney transplantation improves overall quality of life and physical functioning, improvements of psychological distress are often modest. However, apparent stressors such as comorbidity are only weakly associated with psychological distress and their impact differs considerably between patients. Wilson and Cleary proposed a theoretical model to explain these relationships. This model has been supported by research, but has never been applied in a population of kidney transplant recipients. Findings of the current study are based on a cross-sectional study carried out in 2008 in the northern Netherlands. An elaborated version of Wilson and Cleary's model specifying hypothesized relationships of objective health, functional status, subjective health, personal characteristics and psychological distress was evaluated with structural equation modelling. After elimination of non-significant paths the final model provided a good fit for the data, $\chi^2(2) = 4.23$, $p = 0.12$; RMSEA = 0.047, CIRMSEA (0; 0.11); ECVI = 0.060, ECVIsat = 0.059. Results suggest that objective health has an indirect effect on psychological distress, in size comparable to the effects exerted by functional status and subjective health. Personal characteristics are the strongest determinant of psychological distress, but are directly and indirectly affected by objective health. Results indicate that poor health might cause psychological distress by increasing coping demands while simultaneously decreasing coping resources.

INTRODUCTION

Despite its undisputable merits as a treatment for end stage renal disease, dialysis is associated with reduced quality of life on physical and psychological dimensions of quality of life (Arenas et al., 2007; Chilcot, Wellsted, Da Silva-Gane, & Farrington, 2008; Cukor, Coplan, Brown, Peterson, & Kimmel, 2008; Johansen, 1999). Kidney transplantation improves physical dimensions of quality of life and is associated with better physical functioning and higher overall ratings of quality of life (Burra & De Bona, 2007; Dobbels, De Bleser, De Geest, & Fine, 2007; Liem, Bosch, Arends, Heijenbrok-Kal, & Hunink, 2007). However, with few exceptions (Cameron, Whiteside, Katz, & Devins, 2000; Franke et al., 2000), improvements on psychological dimensions of quality of life are reported to be modest or non-existent (Dew et al., 1997; Dobbels et al., 2007; Landreneau, Lee, & Landreneau, 2010; Liem et al., 2007; Ogutmen et al., 2006; Overbeck et al., 2005). These findings suggest that even after successful kidney transplantation, patients experience reduced well-being and increased psychological distress (Dobbels et al., 2008). Addressing psychological distress is relevant to improve patient well-being and might also have positive secondary effects on adherence, morbidity and mortality (Achille, Ouellette, Fournier, Vachon, & Hebert, 2006; Cukor, Rosenthal, Jindal, Brown, & Kimmel, 2009; Dew et al., 2000; Khalil & Frazier, 2010; Khalil, Lennie, & Frazier, 2010; Lundberg, 2006).

While psychological distress has numerous causes, health-related stressors can be expected to play an important role for its manifestation in a chronically ill population such as recipients of a kidney transplant. The prevalence of medical conditions related to cardiovascular disease is high among patients with end stage renal disease (Athienites et al., 2000; Foley, 2003; Foley, 2006; Khan, 1998; Levin, 2003) and prolonged immunosuppressive treatment after transplantation is associated with the development of new medical conditions, such as malignancies, diabetes and infections (Kauffman, 2006; Kauffman, Cherikh, McBride, Cheng, & Hanto, 2006; Luan, Langewisch, & Ojo, 2010; Luan, Steffick, & Ojo, 2011; Ojo, 2006; Parasuraman, Yee, Karthikeyan, & del Busto, 2006).

However, kidney transplant recipients with higher disease burden (i.e., more comorbidity) will not necessarily be more distressed. Research has found that associations between psychological distress and objective markers of health such as the number of medical conditions are weaker than might be anticipated (Kempen, Jellicic, & Ormel, 1997; Kempen, Ormel, Brilman, & Relyveld, 1997; Koopmans & Lamers, 2005; Paukert et al., 2010;

Saevareid, Thygesen, Nygaard, & Lindstrom, 2007; Thygesen, Saevareid, Lindstrom, & Engedal, 2009). These observations can be understood within the theoretical framework of the conceptual model of patient outcomes proposed by Wilson and Cleary (1995). According to their model, objective health does not have a direct influence on psychological distress. Instead, the basic structure of their model suggests that the influence of objective health on psychological distress is mediated by functional status and subjective health, the latter having a direct impact on psychological distress.

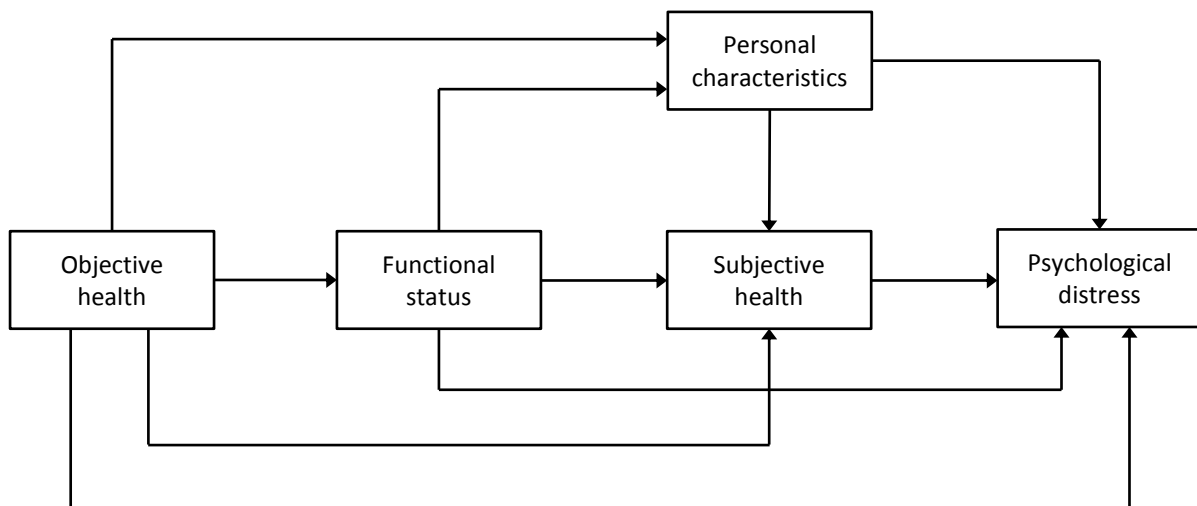
Research in elderly populations, as well as patients with cancer, Parkinson's disease, heart disease, and HIV has corroborated most of the relationships specified in Wilson and Cleary's model (Chrischilles, Rubenstein, Voelker, Wallace, & Rodnitzky, 2002; Lee, Yu, Woo, & Thompson, 2005; Sousa & Kwok, 2006; Sullivan, Kempen, Van Sonderen, & Ormel, 2000; Ulvik, Nygard, Hanestad, Wentzel-Larsen, & Wahl, 2008; Wettergren, Bjorkholm, Axdorph, & Langius-Eklof, 2004). It was found that objective health is related to functional status and that functional status is related to subjective health (Arnold, Ranchor, Koeter, de Jongste, & Sanderman, 2005; Bayliss, Ellis, & Steiner, 2005; Bentsen, Henriksen, Wentzel-Larsen, Hanestad, & Wahl, 2008; Flynn et al., 2009; Schneider et al., 2004; Sullivan et al., 2000). Studies have also shown that subjective health is associated with psychological distress and well-being (Cappeliez, Sèvre-Rousseau, Landreville, & Prévile, 2004; Kelley, Whitley, Sipe, & Yorker, 2000; Schneider et al., 2004). However, relationships not specified in the model have also been observed. Some studies report direct effects of objective health on subjective health and psychological distress (Cappeliez et al., 2004; Gadalla, 2009a; Saevareid et al., 2007; Schneider et al., 2004; Sullivan et al., 2000). Other studies describe direct effects of functional status on psychological distress (Deimling, Bowman, Sterns, Wagner, & Kahana, 2006; Janz et al., 2004; Norton et al., 2005).

Personal characteristics of patients are another reason for the modest association between objective health and psychological distress. According to cognitive adaptation theory, personal characteristics, more specifically mastery, optimism and self-esteem directly affect psychological distress (Taylor, 1983; Thoits, 2010). Wilson and Cleary's model suggests that personal characteristics affect psychological distress not only directly, but also indirectly by influencing functional status and subjective health. Research has confirmed that higher levels of personal characteristics such as perceived control over life (i.e. mastery), optimism and self-esteem are associated with increased well-being and decreased

psychological distress (Gadalla, 2009b; Janz et al., 2004; Pritchard, Wilson, & Yamnitz, 2007; Stiegelis et al., 2003). However, contrary to Wilson and Cleary's assumptions, evidence suggests that personal characteristics such as mastery are affected by objective health and functional status, not vice-versa (Norton et al., 2005; Penninx et al., 1996; Ranchor et al., 2010). These changes in turn have an impact on subjective health and psychological distress.

The aim of the current study is to identify pathways through which objective health affects psychological distress and to clarify how personal characteristics are shaped by objective health and determine psychological distress. This aim will be achieved by evaluating an adapted model of objective health and psychological distress elaborated from Wilson and Cleary's conceptual model of patient outcomes (Figure 1) (Wilson & Cleary, 1995). In line with research evidence, the model allows for paths between non-adjacent variables, e.g. between objective and subjective health and between functional status and psychological distress (Deimling et al., 2006; Sullivan et al., 2000). Also, objective health and functional status are hypothesized to influence personal characteristics (Norton et al., 2005; Penninx et al., 1996; Ranchor et al., 2010).

Figure 1. Elaborated model of psychological distress based on Wilson & Cleary (1995).



This study is the first attempt to explicate pathways through which objective health affects psychological distress in a sample of kidney transplant recipients. Given the high

prevalence of comorbidity among kidney transplant recipients, understanding how objective health affects psychological distress and what role personal characteristics play in this relationship is relevant to prevent and alleviate psychological distress in this population.

MATERIALS AND METHODS

Sampling procedures

From the hospital database patients were selected who had (a) received a kidney graft between 1st of January 1993 and 28th of April 2008, (b) were living with a functioning kidney graft at the time of data extraction, (c) were at least 18 years of age, and (d) had received a single-organ, kidney-only transplant. This query resulted in a potential sample of 1036 patients. Non-respondents received a reminder after three and seven weeks. Data for this cross-sectional study were collected from June to September 2008. The Medical Ethical Committee of the University Medical Center Groningen approved of the study and the procedures.

Sample

During data collection 22 patients were excluded due to the following exclusion criteria: (a) unknown address (N = 13), (b) inability to comprehend Dutch (N = 7) and (c) visual impairment (N = 2), resulting in an eligible group of 1014 patients from whom 609 questionnaires were returned (60% response rate). Respondents (Mean = 53.7 years; SD = 12.3 years) were significantly older than non-respondents (Mean = 49.1 years; SD = 13.7 years) with $t = 5.40$, $p < 0.001$. No differences between respondents and non-respondents were found regarding gender, donor status, or 24-hour creatinine clearance. With the exception of a minor age difference, the sample was representative of the target population.

Measures

Objective health

Kidney transplant recipients are a chronically ill population with a high prevalence of comorbidity (Dobbels et al., 2007; Matas et al., 2002). Therefore, the number of active comorbidities reported by patients was used as an indicator of objective health (Hong, Oddone, Dudley, & Bosworth, 2005; Kempen et al., 1997; Kempen, Ormel et al., 1997;

Paukert et al., 2010; Sullivan et al., 2000). Comorbidity was assessed with an adapted version of a checklist of twenty common medical conditions used by the Central Office for Statistics in the Netherlands for its periodical General Health Survey (Arnold et al., 2004; Kempen et al., 1997; Kempen, Ormel et al., 1997; van den Bos, 1995). Examples of medical conditions included in the checklist are airway infections, stroke, high blood pressure and cancer. For each medical condition patients were asked to indicate if they were diagnosed with the condition (yes/no) and if they had received treatment for this condition in the last twelve months (yes/no). Active comorbidities were added up. To facilitate the interpretation of results, the actual number of active comorbidities was reversed, resulting in a score range from 1-10 with higher scores indicating better objective health. Research has shown that self-reports of comorbidity tend to be accurate, thus reliable and valid, representations of actual comorbidity (Bayliss et al., 2005; Kriegsman, Penninx, van Eijk, Boeke, & Deeg, 1996; Penninx et al., 1996; van den Bos, 1995).

Functional status

Well-established self-report measures of functional status (i.e. physical functioning) use items tapping into problems with mobility, self-care and the performance of usual activities (Aaronson et al., 1993; Meenan, Mason, Anderson, Guccione, & Kazis, 1992; Schag, Heinrich, & Ganz, 1984; J. E. Ware Jr & Sherbourne, 1992; J. E. Ware, Snow, Kosinski, & Gandek, 1993). These three dimensions were assessed with the EQ-5D which distinguishes three levels of severity: no problems, some problems and extreme problems. Studies in the general population and various patient populations have shown that the EQ-5D has acceptable reliability and validity (Brazier, Roberts, Tsuchiya, & Busschbach, 2004; Cleemput et al., 2004; Gerard, Nicholson, Mullee, Mehta, & Roderick, 2004; Hoeymans, van Lindert, & Westert, 2005; Johnson & Coons, 1998; Stavem, Froland, & Hellum, 2005).

Functional status was operationalized as a single factor score of these dimensions, in which higher scores indicate a higher functional status. Spearman correlations were $r = 0.29$ for mobility and self-care, $r = 0.55$ for mobility and usual activities and $r = 0.28$ for self-care and usual activities. All correlations were significant at $p < 0.001$. Scale scores were entered into a principal component analysis and a single factor was extracted. This single unrotated component explained 59% of the variance. Factor loadings were 0.82 for mobility, 0.63 for

self-care and 0.83 for usual activities and were subsequently used as weights to construct a variable designated as functional status.

Subjective health

Alongside its descriptive system the EQ-5D contains a visual analogue scale (EQ-VAS). Respondents are instructed to rate their current health state on a vertical visual analogue scale running from 0 to 100, comparable to a thermometer. The endpoints are labeled 'Best imaginable health state' (100) and 'Worst imaginable health state' (0). Studies in the general population and various patient populations have shown that the EQ-5D with VAS has acceptable reliability and validity (Brazier et al., 2004; Cleemput et al., 2004; Gerard et al., 2004; Hoeymans et al., 2005; Johnson & Coons, 1998; Stavem et al., 2005).

Personal characteristics

Index of personal characteristics: Cognitive adaptation theory hypothesises that mastery, optimism and self-esteem are associated with well-being and crucial for adjustment to adverse events (Taylor, 1983). An index of these personal characteristics was constructed as a single factor score of mastery, optimism and self-esteem in accordance with previous studies (Helgeson, 1999; Helgeson, 2003; Peeters, Ranchor, Vliet Vlieland, & Stiggelbout, 2010). Zero-order correlations were $r = 0.50$ for mastery and optimism, $r = 0.50$ for mastery and self-esteem and $r = 0.61$ for optimism and self-esteem. All correlations were significant at $p < 0.001$. Scale scores for mastery, optimism and self-esteem were entered into a principal component analysis and a single factor was extracted. This single unrotated component explained 69 % of the variance. Factor loadings were 0.79 for mastery, 0.85 for optimism and 0.85 for self-esteem and were subsequently used as weights to construct a variable designated as index of personal characteristics. Higher scores indicate higher degrees of the personal characteristics mastery, optimism and self-esteem.

Mastery: The mastery scale is a 7-item measure assessing general feelings of control over life. Psychometric properties of the mastery scale have been reported to be adequate (Arnold et al., 2004; Pearlin & Schooler, 1978). An example item is 'I have little control over the things that happen to me'. Items are scored on a 5-point Likert scale running from 'strongly disagree' to 'strongly agree'. The total scale score ranges from 7 to 35, with higher

scores indicating more perceived control over life. Cronbach's α in the current sample was 0.67.

Optimism: Optimism was measured with the Life Orientation Test (Scheier & Carver, 1985), which assesses generalized expectancies for positive outcomes. The eight items of the scale are scored on a 5-point Likert scale running from 'strongly disagree' to 'strongly agree'. An example item is 'In uncertain times, I usually expect the best'. The total scale score ranges from 8 to 40, with higher scores indicating greater optimism. Convergent and discriminant validity of the LOT are reported to be acceptable (Scheier, Carver, & Bridges, 1994). Cronbach's α in the current sample was 0.71.

Self-esteem: Self-esteem was measured using the Rosenberg Self-Esteem Scale (Rosenberg, 1965), which assesses global self-esteem and feelings of self-worth. The scale includes ten items scored on a 4-point Likert scale running from 'strongly disagree' to 'strongly agree'. An example item is 'On the whole I am satisfied with myself'. The total scale ranges from 10 to 40, with higher scores indicating higher levels of self-esteem. Reliability and validity of the Dutch version are reported to be good (Franck, De Raedt, Barbez, & Rosseel, 2008). Cronbach's α in the current sample was 0.85.

Psychological distress

Psychological distress was assessed with the 12-item version of the General Health Questionnaire (D. Goldberg & William, 1988). The GHQ-12 possesses good psychometric properties (Furer, König-Zahn, & Tax, 1995; D. P. Goldberg et al., 1997) and is frequently used in medical populations, including kidney transplant recipients (Prihodova et al., 2010). The questionnaire consists to even parts of positively and negatively worded items. An example of a negatively worded item is 'Have you recently lost much sleep over worry?'. There are four answering categories: 'not at all', 'no more than usual', 'rather more than usual' and 'much more than usual'. Items scores are added up to calculate the scale score which ranges from 12 to 48, with higher scores indicating higher levels of psychological distress. Cronbach's alpha in the current sample was 0.90.

Statistical analyses

To examine the representativeness of the sample, respondents and non-respondents were compared using Student t-test and Pearson Chi-square. Analysis of missing values was

performed to identify patterns of missing data. Little's Chi-square statistic was calculated to test if data were missing completely at random. Cases with missing data on variables included in the model were compared to complete cases on socio-demographic and medical variables with Student t-test and Pearson chi-square. The tenability of the elaborated theoretical model linking objective health to psychological distress was evaluated with structural equation modeling using LISREL 8.72 (Jöreskog & Sörbom, 2004). Single indicators of latent variables specified in the model were used. Analyses were based on the covariance matrix of dependent and independent variables. Model fit was assessed by means of X^2 , root mean square error of approximation (RMSEA) with confidence interval (CI_{RMSEA}) and estimated cross-validation index (ECVI). The X^2 statistic is a measure of overall model fit and tests the null hypothesis that the model fits the population data perfectly. Rejection of the null hypothesis implies imperfect fit and therefore X^2 should not be significant. The RMSEA estimates the discrepancy of approximation per degree of freedom, thus taking model complexity into account. General consensus is that values below 0.05 indicate good fit and values below 0.08 reasonable fit. The ECVI measures the discrepancy between the model derived from the sample and an expected model obtained from another sample of equal size. Its value is only informative in comparison to the ECVI of other models. Values close to or lower than the ECVI for the saturated (i.e. just-identified) model indicate good fit of the model (Diamantopoulos & Siguaw, 2000).

RESULTS

Sample characteristics

Missing data analysis identified 103 cases with incomplete data on one or more variables included in the theoretical model. Missing values amounted to 4.7% of the complete dataset. Little's chi-square test was non-significant, $X^2 (62) = 72.890$, $p = 0.162$, indicating that data were missing completely at random. Further analysis revealed no differences between complete and incomplete cases with regards to socio-demographic, medical, dependent or independent variables. Therefore, listwise deletion of cases with missing values was considered appropriate and all subsequent analyses will be based on the subset of the sample with complete data ($N = 506$). Demographic and medical characteristics of this sample are presented in Table 1.

Table 1. Demographic and medical characteristics of the patient sample (N=506).

Variable	Mean \pm SD (range)
Age	53.3 \pm 12.2 (20-82)
Gender (% male)	56.1 %
Educational level	
Elementary	49.7 %
Secondary	28.8 %
University	21.5 %
Relationship status (% with partner)	78.8 %
Time on dialysis (years)	3.2 \pm 2.7 (0-20)
Donor status (% deceased donor)	67.2 %
Time since transplantation (years)	5.9 \pm 4.3
24-hour creatinine clearance (mL/min)	57.4 \pm 20.0 (15-117)
Primary kidney disease	
Glomerulonephritis	38.1 %
Congenital and hereditary kidney diseases	27.1 %
Renal vascular diseases including diabetes mellitus	12.0 %
Other	22.8 %

Data screening

Standardised residuals of the dependent variable were normally distributed and all variables followed a normal distribution. Independent variables demonstrated linear relationships with each other and the dependent variable. A fitting model would a posteriori corroborate that the assumption of normality is met for the multivariate distribution. Variance inflation factors were close to 1 for all independent variables and additional inspection of the condition indices confirmed that multicollinearity was not a concern. Residuals were independent, with Durbin-Watson statistic close to 2 and followed a normal distribution. Thus, data screening confirmed that assumptions for structural equation modeling were met.

Descriptive statistics

Zero-order correlations, means and standard deviations are presented in Table 2. Correlations indicate that variables hypothesized to mediate the influence of objective

health on psychological distress are more strongly related to psychological distress than objective health itself.

Table 2. Zero-order correlations, means and standard deviations of dependent and independent variables.

	1	2	3	4	5
1 Psychological distress	-				
2 Objective health	-0.278***	-			
3 Functional status	-0.378***	0.467***	-		
4 Subjective health	-0.466***	0.435***	0.613***	-	
5 Personal characteristics	-0.511***	0.291***	0.407***	0.490***	-
Mean \pm SD (range)	10.5 \pm 5.8 (0-34)	8.3 \pm 1.6 (1-10)	6.0 \pm 0.8 (3-7)	74.2 \pm 14.2 (10-100)	69.9 \pm 8.9 (44-92)

*** $p < 0.001$

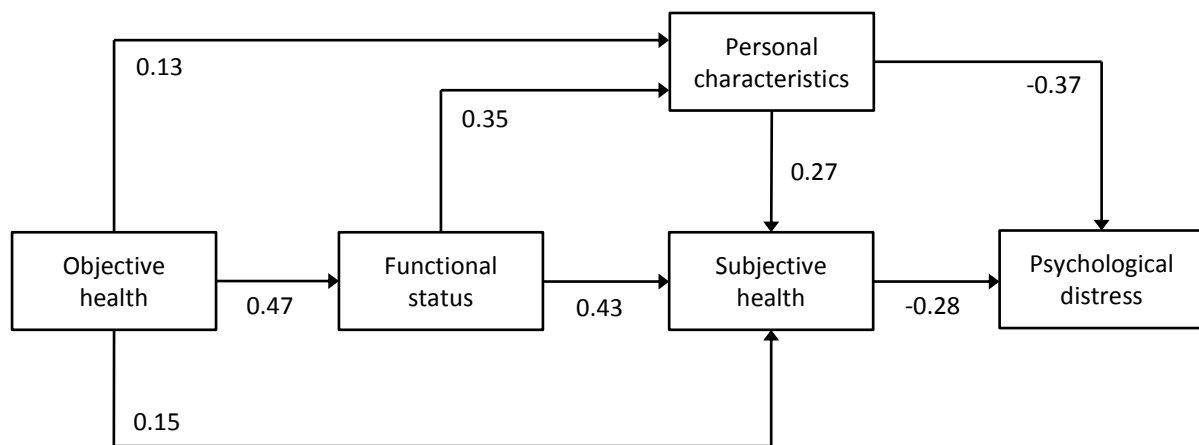
Structural equation modeling

Starting from a saturated (i.e. just-identified) model with zero degrees of freedom, non-significant paths of the structural model were successively removed. After removal of a path, the model fit was evaluated and compared to previous models. Removal of the non-significant path with the smallest t-value between objective health and psychological distress, $\beta = -0.04$; $t = -0.94$, $SE = 0.04$, resulted in a model with $X^2 (1) = 0.89$, $p = 0.35$; $RMSEA = 0$, $CI_{RMSEA}(0; 0.12)$; $ECVI = 0.057$, $ECVI_{sat} = 0.059$. Removal of the non-significant path between functional status and psychological distress, $\beta = -0.09$; $t = -1.84$, $SE = 0.05$, lead to the final model with $X^2 (2) = 4.23$, $p = 0.12$; $RMSEA = 0.047$, $CI_{RMSEA} (0; 0.11)$; $ECVI = 0.060$, $ECVI_{sat} = 0.059$. All three goodness of fit indices attested good model fit. The final model is presented in Figure 2.

To gain more insight into the relative importance of each personal characteristic, three separate models were assessed in which the index of personal characteristics was replaced either by mastery, optimism or self-esteem. As before, non-significant paths were successively removed. According to all three goodness of fit indices, the final model for mastery [$X^2 (1) = 1.26$, $p = 0.26$; $RMSEA = 0.023$, $CI_{RMSEA} (0; 0.12)$; $ECVI = 0.058$, $ECVI_{sat} = 0.059$], optimism [$X^2 (1) = 0.88$, $p = 0.35$; $RMSEA = 0.0$, $CI_{RMSEA} (0; 0.12)$; $ECVI = 0.057$, $ECVI_{sat}$

= 0.059], as well as self-esteem [$X^2 (2) = 4.41, p = 0.11$; RMSEA = 0.049, $CI_{RMSEA} (0; 0.11)$; ECVI = 0.060, $ECVI_{sat} = 0.059$] provided good fit for the data. Nevertheless, the model using the single index of personal characteristics was the most parsimonious (i.e. more degrees of freedom) and best fitting model.

Figure 2. Final model of psychological distress with beta coefficients.



Note: $X^2 (2) = 4.23, p = 0.12$; RMSEA = 0.047, $CI_{RMSEA} (0; 0.11)$; ECVI = 0.060, $ECVI_{sat} = 0.059$

The direct, indirect and total effects on psychological distress in the final model using the index of personal characteristics are presented in Table 3.

Table 3. Beta coefficients (SE) of direct, indirect and total effects of predictors in final model of psychological distress.

Model	Objective health	Functional status	Subjective health	Personal characteristics
Direct effect	-	-	-0.28 (0.04)	-0.37 (0.04)
Indirect effect	-0.23 (0.03)	-0.28 (0.03)	-	-0.08 (0.02)
Total effect	-0.23 (0.03)	-0.28 (0.03)	-0.28 (0.04)	-0.45 (0.04)

The impact of objective health and functional status on psychological distress is fully mediated by subjective health and personal characteristics. Objective health accounts for 22% of variance in functional status ($R^2 = 0.22$). Objective health and functional status together account for 18% of variance ($R^2 = 0.18$) in personal characteristics. Objective health, functional status and personal characteristics together account for 46% of variance ($R^2 = 0.46$) of subjective health. Altogether, the model explains 32% of variance ($R^2 = 0.32$) of psychological distress. Results indicate four pathways through which objective health influences psychological distress, all of which are indirect. The influence of objective health on psychological distress is either a) mediated successively by functional status and personal characteristics, b) mediated successively by functional status and subjective health, c) mediated exclusively by personal characteristics or d) mediated exclusively by subjective health.

DISCUSSION

The aim of the current study was to investigate how objective health affects psychological distress in kidney transplant recipients and to clarify how personal characteristics are shaped by objective health and determine psychological distress. To achieve this aim, an elaborated model of objective health and psychological distress was evaluated.

The influence of objective health on psychological distress is exerted indirectly. The only direct influences on psychological distress originate from patient's subjective interpretation of their health and from their personal characteristics, defined as a total score on mastery, optimism and self-esteem. Results suggest that each of these personal characteristics is important. Better subjective interpretations of health and higher levels of mastery, optimism and self-esteem are associated with less psychological distress. Objective health exerts an indirect influence on patient's psychological distress through its direct relation with subjective interpretations of health, functional status and levels of personal characteristics. Poor health is associated with poor functional status, poor subjective interpretations of health and lower levels of mastery, optimism and self-esteem. This implies that vital resources which are necessary to cope with illness are diminished by illness, leading to a paradoxical situation: when disease burden is high and coping resources are needed most, they are least available.

Current findings attenuate the results of other studies concluding that psychological distress is mainly influenced by functional status and subjective health (Cappeliez et al., 2004; Deimling et al., 2006; Janz et al., 2004; Kelley et al., 2000; Norton et al., 2005; Schneider et al., 2004) and that objective health is only moderately associated with psychological distress (Kempen et al., 1997; Kempen, Ormel et al., 1997; Koopmans & Lamers, 2005; Paukert et al., 2010; Saevareid et al., 2007; Thygesen et al., 2009). Instead, results suggest that objective health has a comparably large but indirect effect on psychological distress. This effect is mediated by other variables, which would explain the previously reported moderate direct association between objective health and distress. Since the operationalization of objective health in the cited studies was equivalent, differing results are probably due to the fact that other studies did not account for indirect effects. Other findings are in line with studies suggesting that personal characteristics are subject to changes during the course of illness (Norton et al., 2005; Penninx et al., 1996; Ranchor et al., 2010). This study gives an indication of a potential origin of these changes.

This study highlights the importance of personal characteristics and subjective health for the development of psychological distress. Kidney transplant recipients have a high risk of developing new medical conditions due to negative effects of immunosuppressive treatment. Therefore, patients with low levels of mastery, optimism and self-esteem and poor subjective health should be identified early on, as they might be especially vulnerable to increased psychological distress. At the same time, interventions designed to preserve or enhance feelings of mastery, optimism and self-esteem should be developed to offset detrimental effects of psychological distress on well-being and possibly even adherence, morbidity and mortality.

This study was the first study to explicate the relationship of objective health status with psychological distress among kidney transplant recipients and the first study to specify the role of personal characteristics in this configuration. Large sample size, high response rate and representativeness of the study population strengthen the results. The single center approach, however, might hinder the generalizability of results to other populations of kidney transplant recipients. While structural equation modeling and the theoretical model suggest causal relationships, the cross-sectional nature of the data strictly does not allow causal inferences.

Findings of this study need to be replicated preferably using longitudinal designs to address potential sources of bias and make causal inferences possible. Specifically, observational studies should be developed which illustrate how objective health might affect personal characteristics. Intervention studies aimed at preventing and alleviating psychological distress in kidney transplant recipients are necessary and their feasibility and cost-effectiveness should be evaluated. Ultimately, these interventions would reduce psychological distress and thereby improve patient well-being with potential secondary effects on adherence and morbidity.

In conclusion, health affects psychological distress in kidney transplant recipients through its effect on subjective interpretations of health and feelings of mastery, optimism and self-esteem. Poor health increases coping demands while simultaneously decreasing coping resources. Various pathways to address psychological distress could prove useful to improve patient well-being.

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